WHAT IS CLAIMED IS:

1   1.   A program storage device, comprising:

2   program instructions executable by a processing device to perform operations for

3   estimating motion trials in video image sequences, the operations comprising:

4   providing data points representing information from an image sequence; and

5   performing regression clustering using a K-Harmonic Means function to cluster the

6   data points and to provide motion information regarding the data points.

1   2.   The program storage device of claim 1, wherein the performing regression

2   clustering using the K-Harmonic Means function to cluster the data points and to provide

3   motion information regarding the data points further comprises providing motion vectors for

4   the data points.

1   3.   The program storage device of claim 1, wherein the performing regression

2   clustering using the K-Harmonic Means function to cluster the data points and to provide

3   motion information regarding the data points further comprises providing at least one motion

4   path for the data points.

1   4.   The program storage device of claim 1, wherein the performing regression

2   clustering further comprises:

3   selecting a number of regression clusters, K, for data points from an image sequence;

4   initializing regression functions for each of the K clusters to estimate the centers of

5   motion for the data points;

6   calculating the distances from each data point to each of the K regression functions;

7   calculating a membership probability and a weighting factor for each data point based

8   on distances between the K regression functions and each data point;

9   applying regression clustering using a K-Harmonic Means function to recalculate the

10   K regression functions;

11   comparing a change in membership probability and a change in the K regression

12   function to a predetermined threshold; and

13   using motion paths represented by the K regression functions when the change in

14   membership probability and change in the K regression function are less than a

15   predetermined threshold.

1   5.   The program storage device of claim 4, wherein the initializing regression

2   functions for each of the K clusters further comprises randomly initializing regression

3   functions for each of the K clusters.

1   6.   The program storage device of claim 4, wherein the program instructions

2 further include instructions for performing the operations comprising repeating the

3 calculating the distances, the calculating membership probability and weighting factors, and

4 applying regression clustering until the change in membership probability and change in the

5 K regression function is not less than the predetermined threshold.

1   7.   The program storage device of claim 4, wherein the weighting factor is chosen

2 to allow the K regression functions to be optimized with less sensitivity to initialization of the

3 K regression functions.

1   8.   The program storage device of claim 4 further comprising extracting data

2 according to a predetermined criteria to provide the data points.

1   9.   The program storage device of claim 8, wherein the extracting data according

2 to the criteria comprises portioning data according to color.

1   10.   The program storage device of claim 4, wherein the program instructions

2 further include instructions for performing the operations comprising preparing each of the

3 data points as x-y-coordinate data points.

1   11.   The program storage device of claim 4, wherein the program instructions

2 further include instructions for performing the operations comprising using the K regression

3 functions to render the image sequence with motion paths shown on a display.

1   12.   The program storage device of claim 11, wherein the using the K regression

2   functions to render the image sequence further comprises overlaying the K regression

3   functions on the video images to show motion between the image sequences.

1   13.   A system for estimating motion trials in video image sequences, comprising:

2   an image sequence retrieval module for retrieving a current image and a first

3   reference image and providing data points representing information from the current image

4   and the first reference image; and

5   a motion estimator, coupled to the image sequence retrieval module, for performing

6   regression clustering using a K-Harmonic Means function to cluster the data points and to

7   provide motion information regarding the data points.

1   14.   The system of claim 13, wherein the motion information regarding the data

2   points further comprises motion vectors for the data points.

1   15.   The system of claim 13, wherein the motion information regarding the data

2   points further comprises at least one motion path for the data points.

1   16.   The system of claim 13, wherein the motion estimator performs regression

2   clustering by selecting a number of regression clusters, K, for data points from an image

3   sequence, initializing regression functions for each of the K clusters to estimate the centers of

4   motion for the data points, calculating the distances from each data point to each of the K

5   regression functions, calculating a membership probability and a weighting factor for each

6   data point based on distances between the K regression functions and each data point,

7   applying regression clustering using a K-Harmonic Means function to recalculate the K

8   regression functions, comparing a change in membership probability and a change in the K

9   regression functions to a predetermined threshold and using motion paths represented by the

10   K regression functions when the change in membership probability and change in the K

11   regression function are less than a predetermined threshold.

1   17.   The system of claim 16, wherein the motion estimator randomly initializes

2   regression functions for each of the K clusters.

1   18.   The system of claim 16, wherein the motion estimator repeats the calculation

2   of the distances, the membership probability and weighting factors, and applies regression

3   clustering until the change in membership probability and change in the K regression

4   function is not less than the predetermined threshold.

1   19.   The system of claim 16, wherein the weighting factor is chosen to allow the K

2   functions to be optimized with less sensitivity to initialization of the K regression functions.

1   20.   The system of claim 16, wherein the motion estimator extracts data according

2   to predetermined criteria.

1   21.   The system of claim 20, wherein the motion estimator extracts data

2 according to color.

1   22.   The system of claim 16, wherein the image sequence retrieval module

2 prepares each of the data points as x-y-coordinate data points.

1   23.   The system of claim 16 further comprising a processor for using the K

2 regression functions to render the image sequence with motion paths shown on a

3 display.

1   24.   The system of claim 23, wherein the processor overlays the K

2 regression functions on the video images to show motion between the current image

3 and the first reference image.

1   25.   A method for estimating motion trials in video image sequences, the

2 method comprising:

3   providing data points representing information from an image sequence; and

4   performing regression clustering using a K-Harmonic Means function to

5 cluster the data points and to provide motion information regarding the data points.

1   26.   The method of claim 25, wherein the performing regression clustering

2 further comprises:

3   selecting a number of regression clusters, K, for data points from an image

4 sequence;

5   initializing regression functions for each of the K clusters to estimate the

6 centers of motion for the data points;

7   calculating the distances from each data point to each of the K regression

8 functions;

9   calculating a membership probability and a weighting factor for each data

10 point based on distances between the K regression functions and each data point;

11   applying regression clustering using a K-Harmonic Means function to

12 recalculate the K regression functions;

13   comparing a change in membership probability and a change in the K

14 regression functions to a predetermined threshold; and

15   using motion paths represented by the K regression functions when the change

16 in membership probability and change in the K regression functions are less than a

17 predetermined threshold.

1   27.   A system for estimating motion trials in video image sequences, comprising:

2   means for retrieving a current image and a first reference image and providing data

3   points representing information from the current image and the first reference image; and

4   means for performing regression clustering, coupled to the means for retrieving and

5   providing, wherein the means for performing regression clustering uses a K-Harmonic Means

6   function to cluster the data points and to provide motion information regarding the data

7   points.

1   28.   The system of claim 27, wherein the means for performing regression

2   clustering further comprises means for selecting a number of regression clusters, K, for data

3   points from an image sequence, means for initializing regression functions for each of the K

4   clusters to estimate the centers of motion for the data points, means for calculating the

5   distances from each data point to each of the K regression functions, means for calculating a

6   membership probability and a weighting factor for each data point based on distances

7   between the K regression functions and each data point, means for applying regression

8   clustering using a K-Harmonic Means function to recalculate the K regression functions,

9   means for comparing a change in membership probability and a change in the K regression

10   functions to a predetermined threshold and means for using motion paths represented by the

11   K regression functions when the change in membership probability and change in the K

12   regression functions are less than a predetermined threshold.

1   29.   A system for estimating motion trials in video image sequences, comprising:

2   means for storing a current image and a first reference image;

3   means, coupled to the means for storing, for retrieving and providing data points

4 representing information from the current image and the first reference image; and

5   means, coupled to the means for retrieving, for performing regression clustering using

6 a K-Harmonic Means function to cluster the data points and to provide motion information

7 regarding the data points.

1   30.   The system of claim 29, wherein the means for performing regression

2 clustering further comprises:

3   means for selecting a number of regression clusters, K, for data points from an image

4 sequence,

5   means for initializing regression functions for each of the K clusters to estimate the

6 centers of motion for the data points,

7   means for calculating the distances from each data point to each of the K regression

8 functions,

9   means for calculating a membership probability and a weighting factor for each data

10 point based on distances between the K regression functions and each data point,

11   means for applying regression clustering using a K-Harmonic Means function to

12 recalculate the K regression functions,

13   means for comparing a change in membership probability and a change in the K

14 regression functions to a predetermined threshold; and

15   means for using motion paths represented by the K regression functions when the

16 change in membership probability and change in the K regression functions are less than a

17 predetermined threshold.